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SAND AND GRAVEL RESOURCES OF THE CHINCHAGA RIVER (SOUTH HALF OF 84E) MAP AREA, ALBERTA

1988-15

Open File Report 1988-02

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1988

91-02463/

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ABSTRACT

The south half of Chinchaga River (84E) map sheet was studied in 1987 to provide information on the distribution and characteristics of the aggregate resource. The study area is approximately 2480 Km^2 in size and was investigated at the enhanced reconnaissance level. The program consisted of compiling existing information, air photo interpretation, field evaluation of some sites and laboratory analyses. Sand and gravel is limited in the area. Major sand and gravel deposits currently exploited are of Tertiary age from pits at Mile 41 and northeast and south of Hotchkiss Airport. In addition, alluvial material is exploited at the intersection of the Chinchaga River and the Chinchaga Forestry Road. Tertiary gravels occur at elevations of 2900' amd 3200'. Using this as an exploration model, two new deposits were discovered south of the Chinchaga Forestry Road. Alluvial material also is present in the Hotchkiss and Meikle River valleys.

INTRODUCTION

This study is part of a program initiated in 1976 by the Alberta Research Council and Alberta Forestry, Lands and Wildlife to provide information on the aggregate resources of the Province of Alberta. The area of study (Figure 1), level of detail and emphasis of the project were determined by the Resource Evaluation and Planning Division (REAP) of Alberta Forest Lands and Wildlife (AFLW). The actual investigations were conducted by the Alberta Geological Survey, a department of the Alberta Research Council.

The study was completed at the enhanced reconnaissance level (Category 4, Table 1). This type of mapping is designed to provide a minimum data level for local and regional planning and management of aggregate resources in the province and to form a base from which further exploration can proceed.

The Chinchaga River map area is bounded by longitudes 118°00' and 120°00' west and latitudes 57°00' and 58°00' north. The study area was confined to an area within townships 94 to 97 and ranges 1 through 10 west of the sixth meridian inclusively. Total area is approximately 2480 Km^2 . There are no population centres in the study area, however, petroleum exploration and exploitation is extensive.

ACKNOWLEDGMENTS

Dianne Goulet performed the laboratory analyses and Monica Price gave her usual superior assistance in the office. Barry Fildes provided major assistance during production of the report. Funds for the project were provided by Resource Planning Division of Alberta Forestry, Lands and Wildlife. The help of the Alberta Forest Service employees in Manning is appreciated.

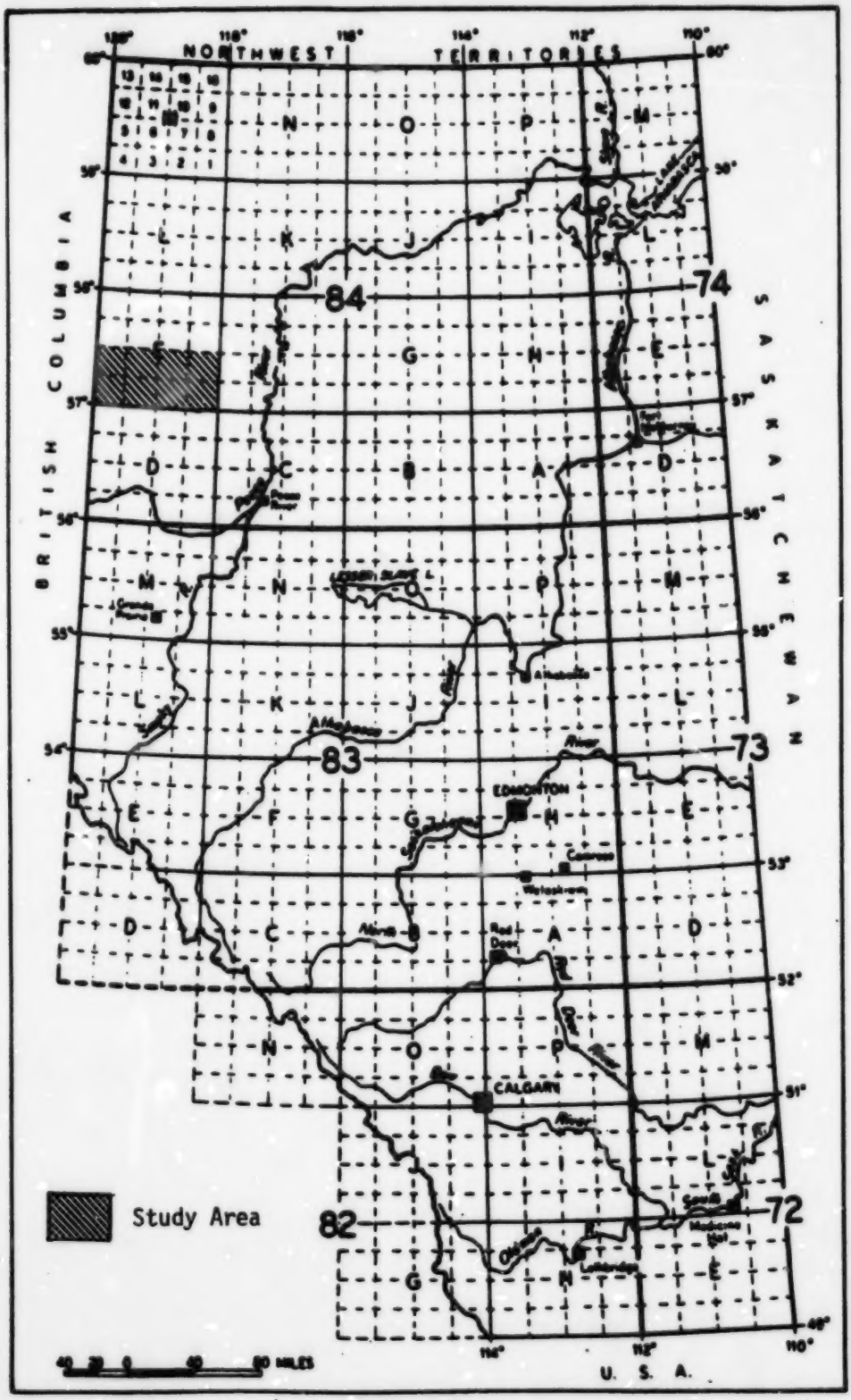

Figure 1 Location Map

Table 1. AGGREGATE INVENTORY MAPPING LEVELS

Format	Reconnaissance Study 5	Enhanced Reconnaissance Study 4	Regional Mapping 3	Detailed Mapping 2	Deposit Evaluation 1
Scale (Common)	1:250,000 (approx. 11x14 townships)	1:250,000 (approx. 11x14 townships)	1:50,000 (approx. 3x3 townships)	1:10,000	1:10,000 or larger
Mapping Methodology	Derived from existing surficial geology information. Aerial photograph interpretation.	Derived from existing surficial geology information. Aerial photograph interpretation. Some field traverses and site examination.	Aerial photograph interpretation Field traverses. Site examinations. Selected deposit testing. Laboratory testing.	Sedimentological studies. Site examination. Deposit testing. Laboratory testing.	Test pitting on an established grid. Hole logging. Materials analysis.
Uses	Broad scale planning. Preliminary aggregate exploration.	Broad scale planning. Preliminary aggregate exploration. Preliminary resource assessment.	Land use planning. Resource management. Resource estimates.	Land management. Reserve estimates. Deposit management.	Deposit evaluation. Development plan preparation.
Comments	Only potential areas suitable for finding deposits shown. Fairly quick and inexpensive to produce.	Potential areas suitable for finding deposits are shown. Some deposits are examined. A map will take 6 months to a year to produce.	Estimates deposit boundaries and gives quality and quantity estimations. A map may take 8 months to a year to produce.	Establishes deposit boundaries. Refines quantity/quality information. Fairly expensive survey.	Precise quality and quantity estimates. Deposit variations identified. Very expensive survey.
Output	2 map sheets per prof-year.	1 map sheet per prof-year.	2 to 3 map sheets per prof-year.	Special projects only.	Special projects only.

METHODS

The study was initiated with the review and compilation of existing information. Included were data from water well logs from Alberta Environment and the files of Alberta Transportation.

The next stage of the investigation involved air photo interpretation of the study area by the principal investigators. This provided a base of information comparable to category 5 as shown on table 1. The primary area of interest to AFLW was then studied in more detail and a number of sites were identified for ground checking.

Field work was conducted in July and August, 1987 by foot, three-wheeled all terrain cycle and truck, followed by helicopter flights in July and September. Access for normal vehicle traffic is very limited. All of the most important features identified through the air photo analysis were investigated and sampled. Samples were returned to the laboratory for grain size and petrographic analyses. A limited number of geophysical traverses using a Geonics EM31 were made in an attempt to detect buried granular material.

This report is based on surface geological observation, limited field checking and limited laboratory data. Application of the results should take account of the reconnaissance nature of the study.

GEOLOGY

Physiography and Bedrock

The map area encloses parts of five districts in the Clear Hills Uplands section of the Northern Alberta Uplands region (Pettapiece, 1986). From west to east (Figure 2) the Milligan Hills, Chinchaga Plain, Clear Hills, Naylor Hills and Notikewin Plain are represented. The study area is covered primarily by portions of the Chinchaga Plain, the Clear Hills and the Notikewin Plain districts. The Milligan Hills district is represented

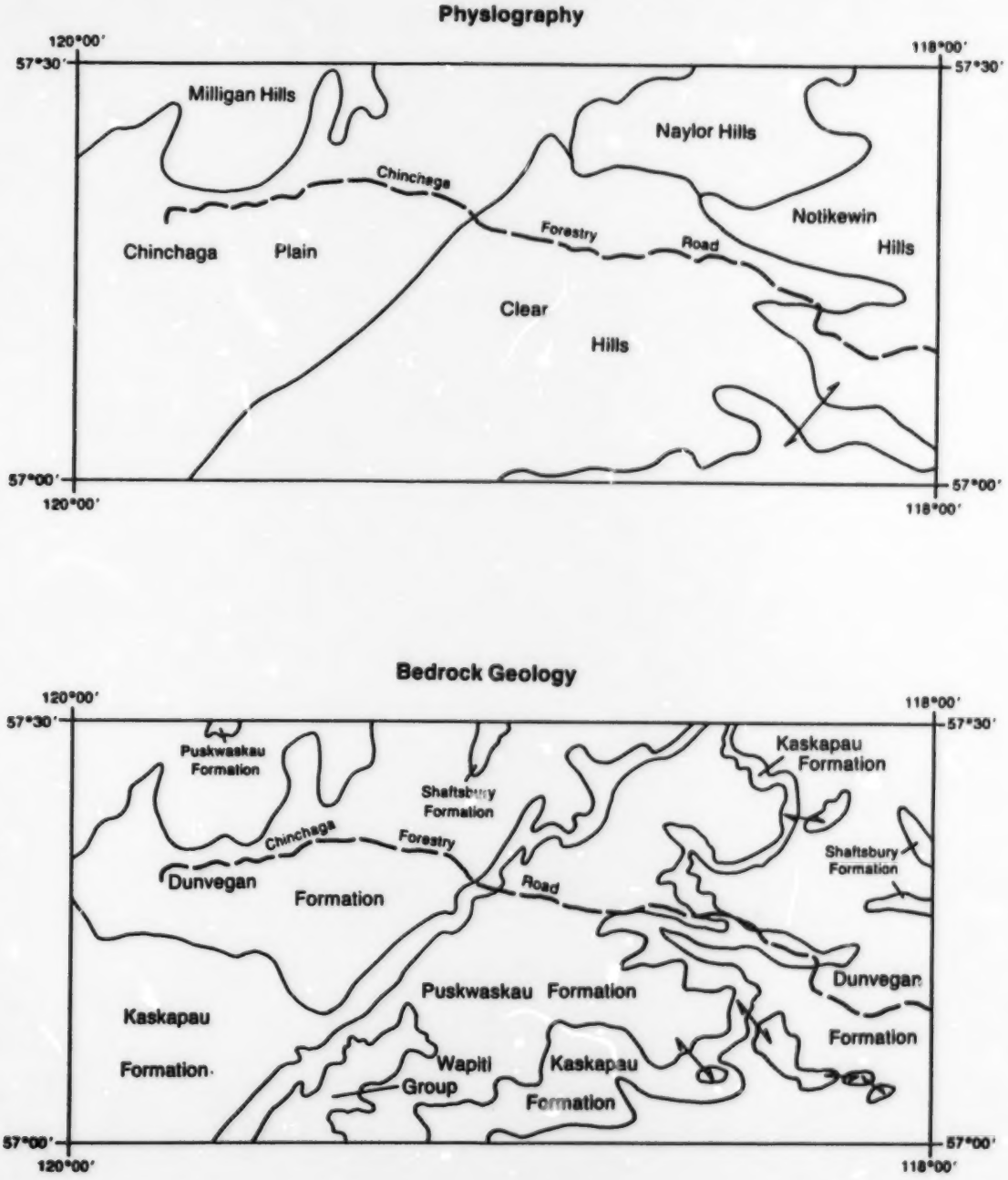

Figure 2. Physiography and Bedrock of the Study Area.

in only parts of two townships and two ranges in the study area and exhibits a maximum elevation, in the study area, of 850m. The Chinchaga Plain, at a minimum elevation of 638m, covers a northeast-trending band approximately five ranges wide and five townships long. The central part of the study area consists mainly of the Clear Hills with the major feature being the Halverson Ridge, at a maximum elevation of 1003m. This district covers portions of eight ranges and four townships and trends northeast. The district to the north of the Clear Hills district is Naylor Hills. This district, with a maximum elevation of 972m in the study area, covers portions of five ranges and two townships and continues on a northeast trend. The district that covers the eastern portion of the study area is the Notikewin Plain which covers portions of four ranges and four townships and has a minimum elevation of 638m. Immediately east of the Notikewin Plain and north of the Naylor Hills are the Peace River Lowlands.

Bedrock (Figure 2) is of Cretaceous age (Green, 1972). The portion of the Milligan Hills district in the map sheet is underlain by Kaskapau Formation, a dark grey silty, marine, shale. The Chinchaga Plain district is underlain mainly by the grey, deltaic sandstone, siltstone and shale of the Dunvegan Formation and by a thin band, in the eastern part of the district, of Kaskapau Formation. The Clear Hills district is underlain by three formations. The largest area is underlain by the gray, fossiliferous, marine shale of the Puskwaskau Formation. The southeast corner of the district is underlain by the gray sandstone, smectitic mudstone and bentonite, scattered coal beds and nonmarine sandstone of the Wapiti Formation. On the east side there is a thin band of the Kaskapau Formation. The Naylor Hills district consists mainly of the Puskwaskau Formation surrounded by a thin band of the Kaskapau Formation. The Notikewan Plain district is underlain by the Dunvegan Formation.

Surficial Geology

No detailed studies are avaliable on the surficial geology of the study area. The desciption of surficial material is based on air photo interpretation, field ground checks and Alberta Transportation data.

Glaciation, the latest major geological event throughout this area, was followed by a period of erosion and deposition which determined the general contour of much of the present surface. The predominent surface material is till. Hummocky topography is common in the till but elevation changes are small in the Chinchaga and Notikewan Plains. Halverson Ridge, in the Clear Hills District, is overlain by surficial material similar to that of the plains area plus deposits of gravel of Early Quaternary or Tertiary age that commonly are called preglacial gravel.

Ice contact features, such as kames and eskers, are not apparent in the study area. Alluvial deposits are present in the Hotchkiss and Meikle Rivers. One deposit (Figure 3, Deposit 9) is of glaciofluvial origin. Glaciofluvial deposits are not of prime importance in this area.

According to Green and Mellon (1962), unconsolidated gravels of preglacial origin are exposed in road cuts about the Clear Hills, Notikewin and Doig fire towers in the southern part of the Clear Hills. The gravels consist of well rounded pebbles up to 15cm in diameter, composed almost exclusively of fine-grained quartzite and chert. A few chert conglomerate pebbles resembling the Lower Cretaceous conglomerates of the Foothills to the west also were observed. The gravels are similar in composition and texture to the preglacial gravels capping many of the residual highlands in other parts of the province, but the thickness, distribution and age within the map-area are unknown save for the information gathered for this study.

SAND AND GRAVEL RESOURCES

Gravel and sand deposits are not abundant in the study area. Deposit, pit, site and/or sample locations and a description of the aggregate resources in the study area are given in figure 3. Deposit, pit and site descriptions and laboratory data are in Appendix 1. Deposits with potential require further investigation and this is noted in the descriptions in Appendix 1.

The gravel and sand bearing deposits are classified on the basis of origin into the two major types listed below.

1. Tertiary or Preglacial Gravels
2. Alluvial Deposits

1. Tertiary or Preglacial Gravels

Gravels of Tertiary age are the major source of sand and gravel in the study area (Figure 3, Deposits 2,3,4,5,7). The major components are charateristically white quartzite and dark gray chert with an iron-rich cement. These gravels commonly are buried beneath till to depths of 2-3m (Figure 3, Deposit 7) with little indication at the surface of their presence. Overburden of this thickness masks these gravels even from detection by geophysical survey using an EM31. It was noted that these deposits commonly occur at elevations of 2900' or 3200' when plotted on topographic maps (Figure 4). Using this theory as a basis for further gravel exploration, two new exposures of Tertiary gravel were located (Figure 3, Deposits 2,5, Figure 4 and Plate 1). Figure 4 highlights the contour intervals that have the highest potential for the location of other deposits of this type. It should be emphasized, however, that deposits will not be found everywhere within these contour intervals and that deposits can be found outside them.

Additional study should be undertaken to confirm the presence of additional gravel within the potential area outlined. The discovery of two new outcrops confirms the theory that this area is the primary place to search.

2. Alluvial Deposits

Alluvial deposits are present in the Meikle and Hotchkiss River drainage systems. Gravelly sand 1 to 1.5m thick, immediately above river level, commonly is exposed in the banks of the Hotchkiss River (Plate 2). It is not known how far the material extends behind any face. Overburden usually is less than 1m, however, so backhoe testing could easily confirm the presence of gravel. Outcrops in the Meikle River valley are much less abundant than in the Hotchkiss River valley and material tends to be much dirtier.

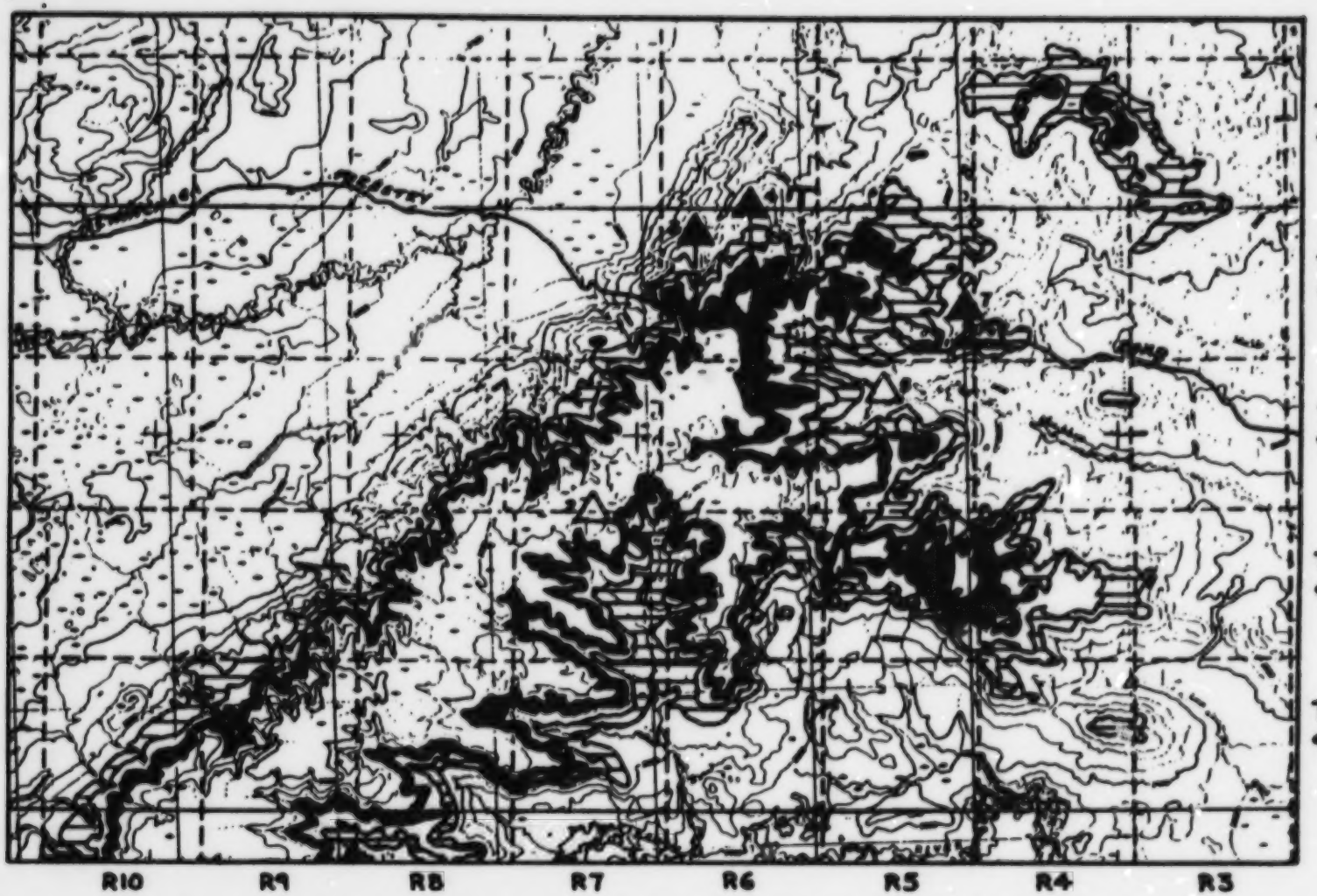

Figure 4. Area of greatest potential for encountering gravel of Tertiary age.

△ New deposits ▲ Exploited deposits

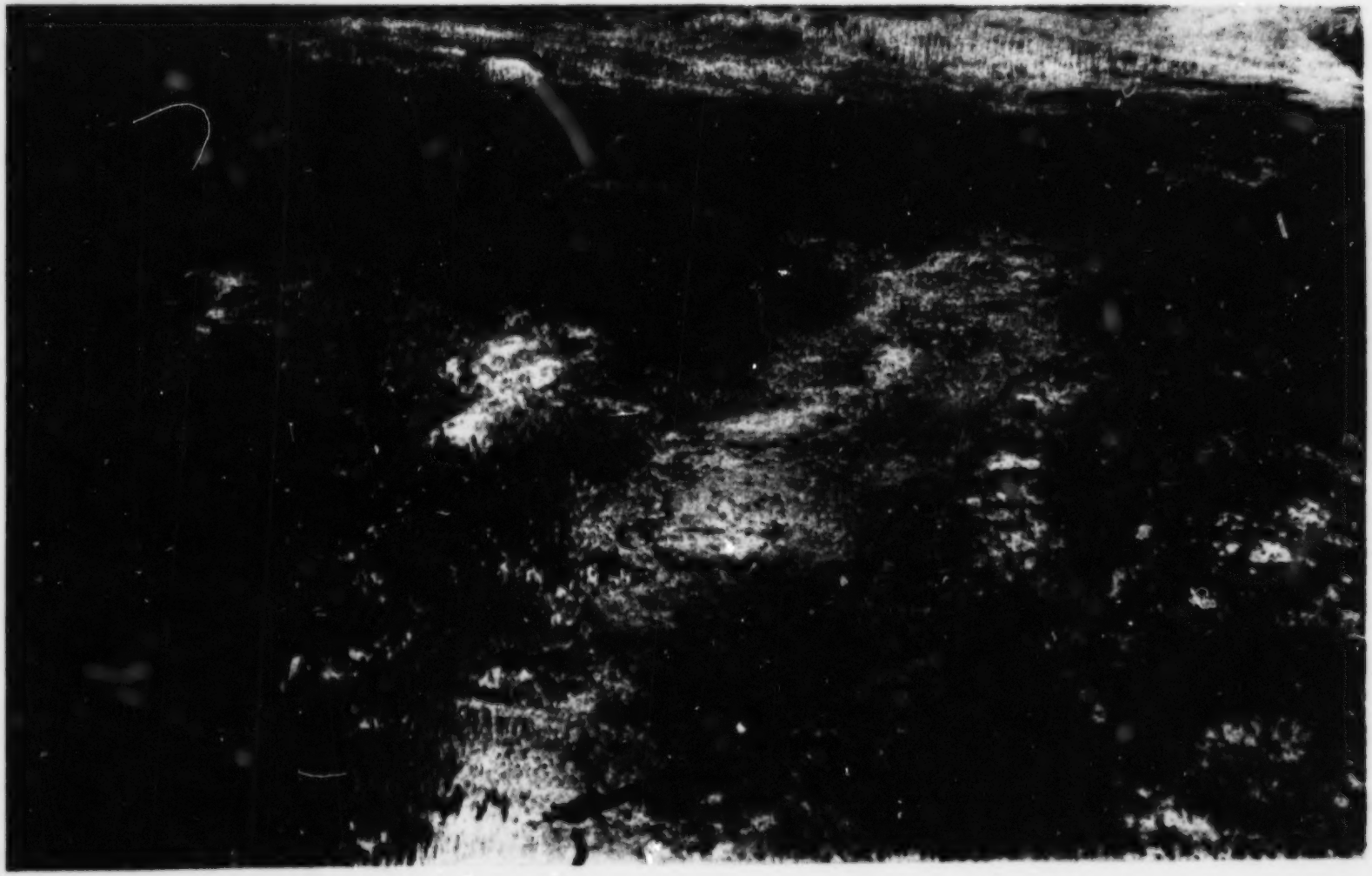

Plate 1. Major gravel exposures of Tertiary age are present on both sides of an unnamed creek in Tp94 R7 W6M (Deposit 2).

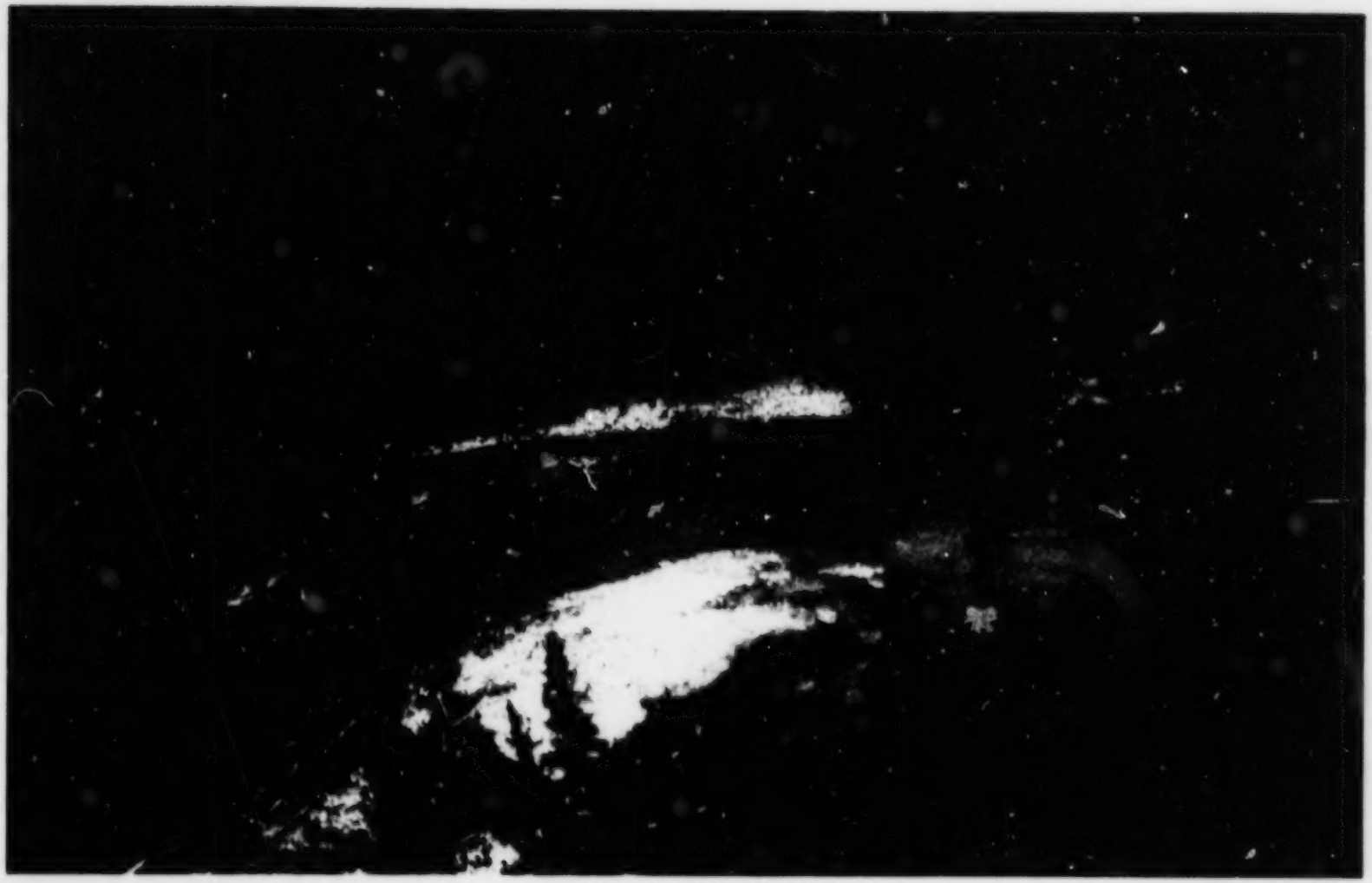

Plate 2. One of many exposures of 1-1.5m of gravelly sand in the banks of the Hotchkiss River (Deposit 6).

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APPENDIX 1
DEPOSIT AND SITE DESCRIPTIONS

DEPOSIT 1

LOCATION: Sec SE25 Tp96 R12 W6M

No. of associated pits/sites: 1

No. of samples analysed: 1

DEPOSIT DESCRIPTION:

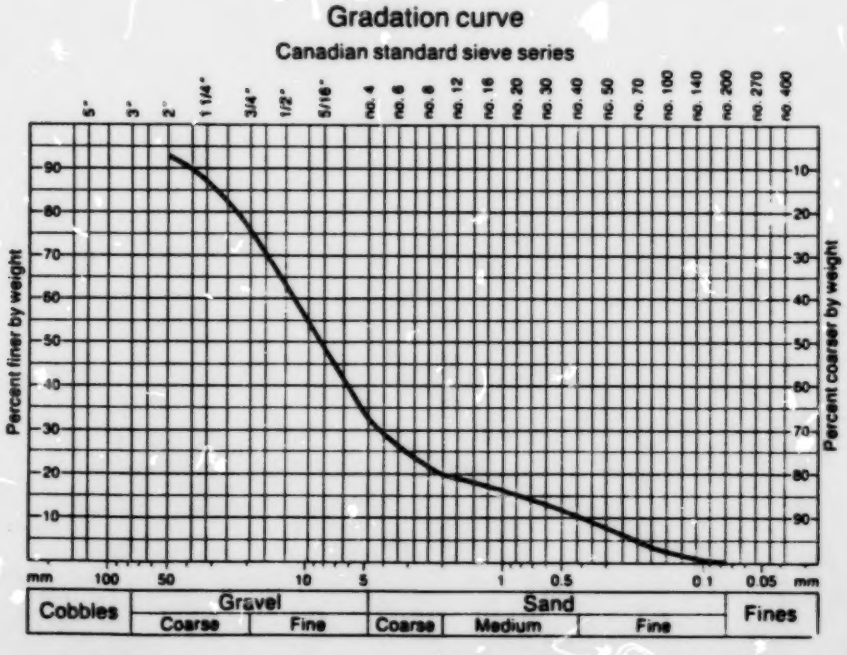
See pit description below. There may be similar terrace deposits elsewhere along the Chinchaga River but no outcrops were observed during an extensive helicopter flyover along the river in either direction from the pit.

Pit Location: Sec SE25 Tp96 R12 W6M

Pit Description:

A river terrace composed of dirty gravelly sand. Overburden consists primarily of 5cm of organic material. Iron stain is common. The southern part of the pit consists of silt to fine sand. Coarser material is present to the north but gravel is not dominant in the pit and clasts larger than 10cm are not present. Clasts consist of quartzite, hard sandstone, granite, gneiss, chert, ironstone and clay clasts.

Gradation: 0% cobbles 66.8% gravel
32.6% sand 0.6% fines
This sample is taken from the coarsest material in the pit.


Gradation curve
Canadian standard sieve series
5" 3" 2" 1 1/4" 3/4" 1/2" 5/16" no. 4 no. 6 no. 8 no. 12 no. 16 no. 20 no. 30 no. 40 no. 50 no. 70 no. 100 no. 140 no. 200 no. 270 no. 400
Percent finer by weight
Percent coarser by weight
90 80 70 60 50 40 30 20 10
10 20 30 40 50 60 70 80 90
mm 100 50 10 5 1 0.5 0.1 0.05 mm
Cobbles
Gravel
Coarse
Fine
Sand
Coarse
Medium
Fine
Fines

DEPOSIT 2

LOCATION: Sec NW25 Tp94 R7 W6M

No. of associated pits/sites: 1

No. of samples analysed: 1

DEPOSIT DESCRIPTION:

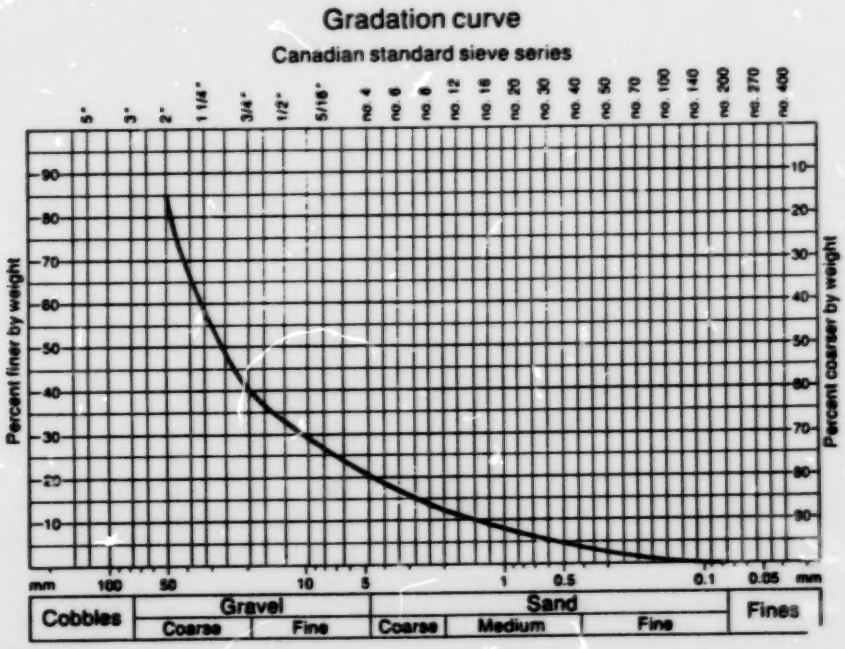
See description below.

Site Location: Sec NW25 Tp94 R7 W6M

Site Description:

An extensive highland of sandy gravel is present on both sides of a creek. Overburden is thin to absent. Quartzite and chert are the dominant clasts. Hard sandstone is minor. Maximum clast size is 25cm. This is a major deposit and should be investigated further. Readings taken during traverses with the EM31 are higher than expected and may be due to abnormal conductivity as a result of the presence of abundant iron in the deposit.

Gradation: 0% cobbles 80% gravel
19.2% sand 0.8% fines


Gradation curve
Canadian standard sieve series
5" 3" 2" 1 1/4" 3/4" 1/2" 5/16" no 4 no 6 no 8 no 12 no 16 no 20 no 30 no 40 no 50 no 70 no 100 no 140 no 200 no 270 no 400
Percent finer by weight
Percent coarser by weight
mm 100 50 10 5 1 0.5 0.1 0.05 mm
Cobbles
Gravel
Coarse
Fine
Sand
Coarse
Medium
Fine
Fines

DEPOSIT 3

LOCATION: Sec NE28 Tp96 R6 W6M

No. of associated pits/sites: 1

No. of samples analysed: 1

DEPOSIT DESCRIPTION:

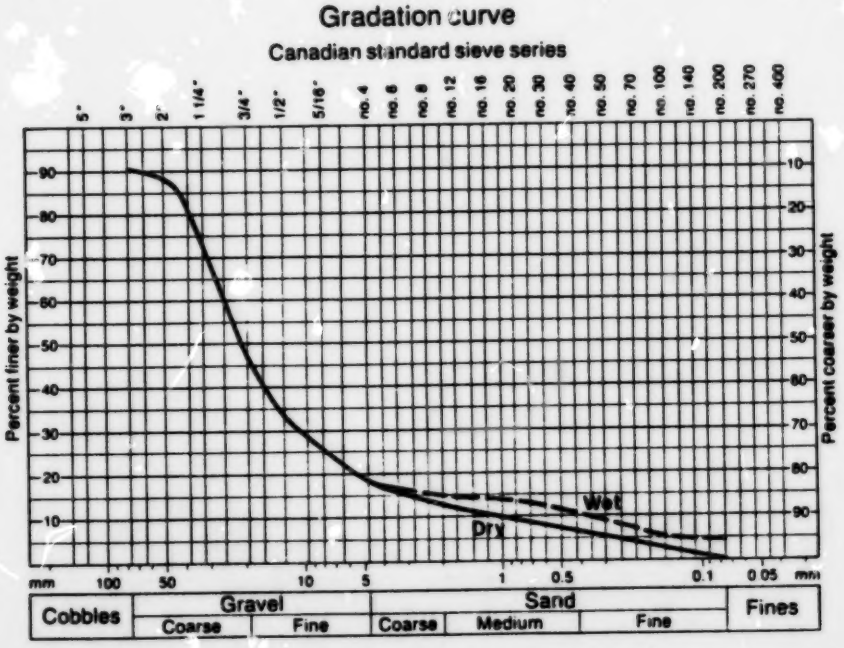
See description below.

Pit Location: Sec NE8 Tp96 R6 W6M

Pit Description:

Sandy gravel 3m thick is present below 0.5-1m of overburden southwest of Hotchkiss airstrip. Quartzite and chert are the dominant clasts. Granite, sandstone and ironstone are minor. Iron stain is minor except in highly iron stained pockets that contain abundant clay and silt. Bedding is indistinct and clasts seem loosely packed. Elevation 3200'.

Gradation:	8.7% cobbles	72.9% gravel	dry sieve
	17.3% sand	1.1% fines	
	8.7% cobbles	72.9% gravel	wet sieve
	13.9% sand	4.5% fines	



DEPOSIT 4

LOCATION: Sec SE22 Tp96 R6 W6M

No. of associated pits/sites: 1

No. of samples analysed: 1

DEPOSIT DESCRIPTION:

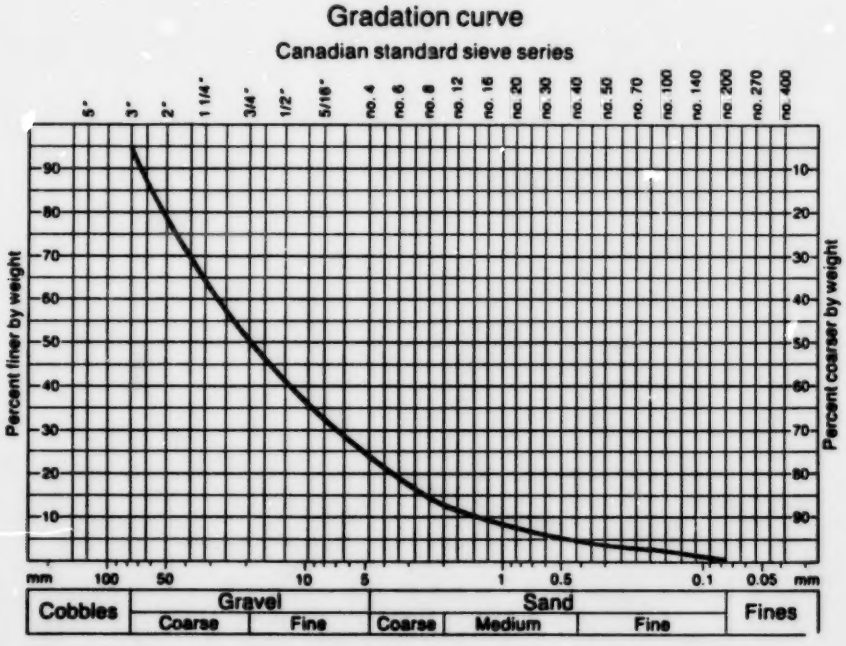
See description below.

Pit Location: Sec SE22 Tp96 R6 W6M

Pit Description:

Two pits 2m deep expose clean, sandy gravel. Overburden is to 1.5m. Maximum clast size is 30cm and most material is between 5cm and 4mm. The sand is coarse to medium and fines are minor. Iron rich bands are present but not abundant. Quartzite and chert are the dominant clasts and clasts of igneous rocks from the Canadian Shield are not apparent. Results of traverses with the EM31 do not suggest that the material extends beyond the currently cleared area. Elevation 3200'.

Gradation:	6.9% cobbles	68.4% gravel
	23.8% sand	0.9% fines


Gradation curve
Canadian standard sieve series
5" 3" 2" 1 1/4" 3/4" 1/2" 5/16" no. 4 no. 6 no. 8 no. 12 no. 16 no. 20 no. 30 no. 40 no. 50 no. 70 no. 100 no. 140 no. 200 no. 270 no. 400
Percent finer by weight
Percent coarser by weight
90 80 70 60 50 40 30 20 10
10 20 30 40 50 60 70 80 90
mm 100 50 10 5 1 0.5 0.1 0.05 mm
Cobbles
Gravel
Coarse
Fine
Sand
Coarse
Medium
Fine
Fines

DEPOSIT 5

LOCATION: Sec SW1 Tp96 R6 W6M

No. of associated pits/sites: 1

No. of samples analysed: None

DEPOSIT DESCRIPTION:

See description below.

Site Location: Sec SW1 Tp96 R6 W6M

Site Description:

Helicopter landing. Elevation 2870'. Outcrop ridge of clean, quartzitic gravel on south side of a creek. No igneous rocks from the Canadian Shield are present. Results from a 90m traverse south along the crest of the ridge with the EM31 indicate the material is aggregate. Results from a 60m traverse north northwest, on the north side of the creek, along a rise of land with the EM31 indicate the material is till.

DEPOSIT 6

LOCATION: Valley bottom of the Hotchkiss River valley west of the sixth meridian.

No. of associated pits/sites: 3

No. of samples analysed: 2

DEPOSIT DESCRIPTION:

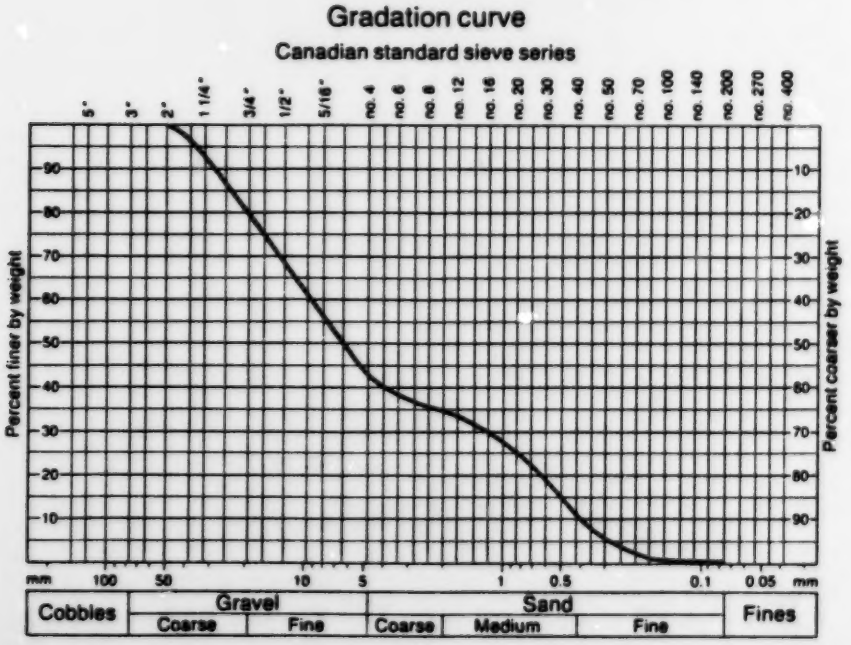
Gravelly sand, 1-1.5m thick, immediately above summer water level in the Hotchkiss River. Overburden to 1m thick may be either silt or sand. Quartzite and chert are the dominant clasts in the western reaches of the river as it rises from Halverson ridge. Further to the east, igneous rocks from the Canadian Shield plus hard sandstone and quartzite are the dominant clasts. A survey by helicopter indicates that this material is abundant along the course of the river.

Site Location: Sec NW11 Tp94 R1 W6M

Site Description:

Gravelly sand, 1.25m thick, exposed above river level beneath 1m of cross-bedded, medium to coarse grained sand with a few clasts to 2cm in size in some beds. The material may extend below river level to an unknown depth. This location deserves more investigation.

Gradation:	0% cobbles	57.1% gravel
	42.6% sand	0.3% fines



Site Location: Sec NW14 Tp94 R2 W6M

Site Description:

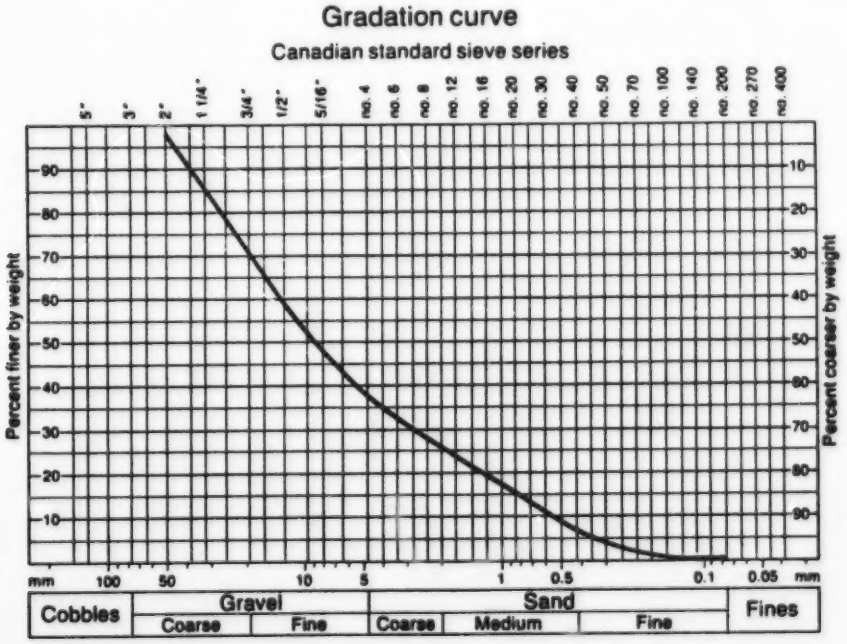
Coarse sand, 1m thick, with lenses of material to 30cm thick, containing clasts to 3cm is present along a 10m face. Silt overburden is 3m thick. No material with clasts is visible in either bank of the river from this position and only a thin veneer of clasts is present on the river bars.

Site Location: Sec NW25 Tp95 R5 W6M

Site Description:

Sandy gravel, 1m thick, below 1m of slightly clayey silt is present in the bank of the Hotchkiss River. It is unknown how far below river level or how far laterally in the vally bottom the material extends. Quartzite and chert are the dominant clasts and pegmatitic granite and conglomerate are minor. This material could be an excellent local source of sandy gravel beneath easily removed overburden. Minor crushing would allow complete use of the resource.

Gradation:	0% cobbles	62.7% gravel
	37.1% sand	0.2% fines



DEPOSIT 7

LOCATION: Sec NW6 Tp96 R4 W6M

No. of associated pits/sites: 1

No. of samples analysed: 5

DEPOSIT DESCRIPTION:

A deposit of sandy gravel of Tertiary age that is the major source of gravel in the map area. Traverses with the EM31 suggest that the deposit is more likely to extend to the west from the current pit outlines than in any other direction.

Pit Location: Sec NW6 Tp96 R4 W6M

Pit Description:

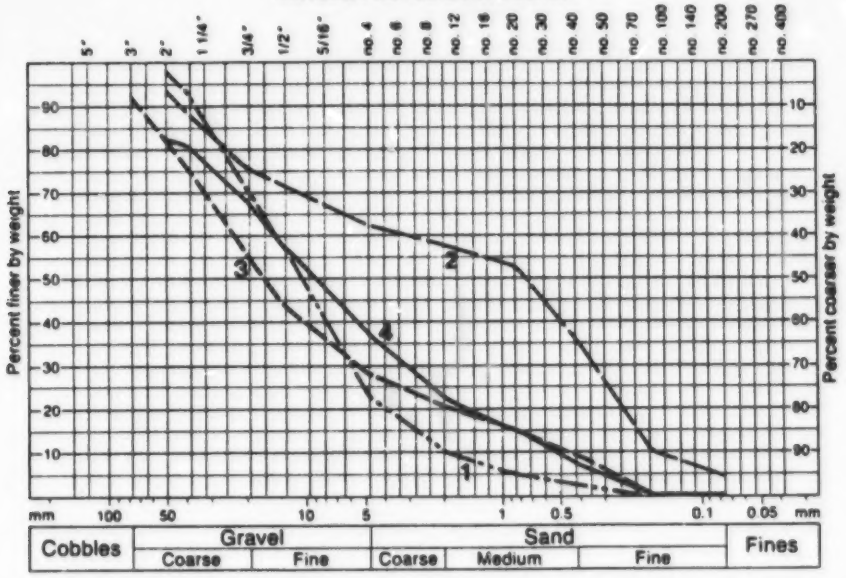
A pit wall of 7m of sandy gravel composed primarily of quartzite clasts is present below 2-3m of till overburden. Contact with the till is sharp. Maximum clast size is 60cm, the coarsest clasts are in the upper 1-2m of the deposit and coarse clasts tend to be present in lenses. Most clasts are smaller than 25cm. Iron stain and iron cement are common and give a yellow through orange to reddish-brown cast to the predominantly white color of the quartzite clasts. Bedding is horizontal but not well developed. Chert clasts also are common and sandstone clasts are minor. Mica flakes are common. Results from an east-west traverse with the EM31, 20m north of the pit, do not suggest that the pit extends to the north for much distance beyond the current highwall. A comparable conclusion is suggested from results of a north-south traverse at the eastern boundary of the current pit. A similar traverse westward from the highwall at the west end of the pit suggests that the gravel may thin or disappear slightly beyond the highwall then thicken or reappear 50m west of the highwall and continue west for an additional 100m. Elevation of pit floor 2920'.

Gradation:

Sample No.			
	1	0% cobbles	75.1% gravel
		24.7% sand	0.2% fines
	2	0% cobbles	37.2% gravel
		58.1% sand	4.7% fines
	3	7.9% cobbles	65.1% gravel
		26.5% sand	0.5% fines
	4	0% cobbles	62.7% gravel
		36.8% sand	0.5% fines

Gradation curve

Canadian standard sieve series

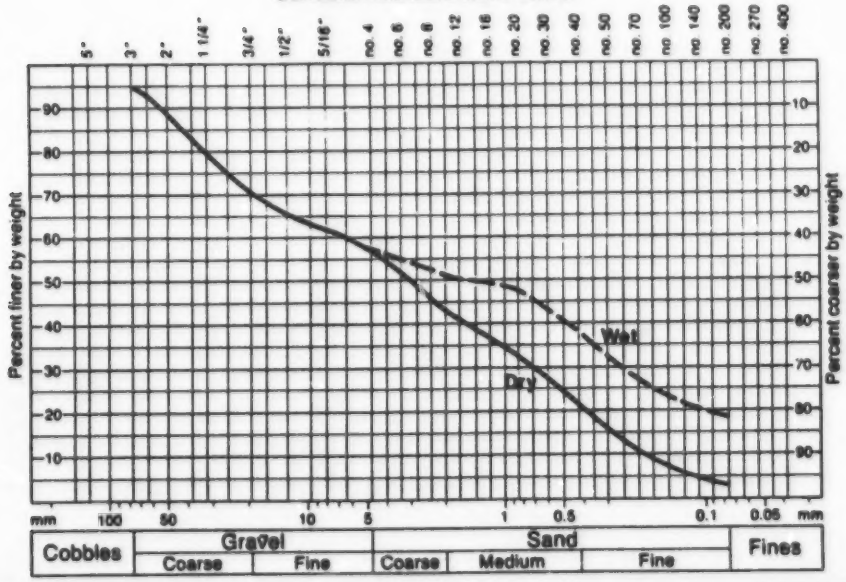

5" 3" 2" 1 1/4" 3/4" 1/2" 5/16" no. 4 no. 6 no. 8 no. 12 no. 16 no. 20 no. 30 no. 40 no. 50 no. 70 no. 100 no. 140 no. 200 no. 270 no. 400
Percent finer by weight
Percent coarser by weight
90 80 70 60 50 40 30 20 10
10 20 30 40 50 60 70 80 90
1
2
3
4
mm 100 50 10 5 1 0.5 0.1 0.05 mm
Cobbles
Gravel
Coarse
Fine
Sand
Coarse
Medium
Fine
Fines

3.8% cobbles 38.9% gravel dry sieve
54.3% sand 3.0% fines

3.8% cobbles 38.9% gravel wet sieve
38.3% sand 19.0% fines

Gradation curve

Canadian standard sieve series


5" 3" 2" 1 1/4" 3/4" 1/2" 5/16" no. 4 no. 6 no. 8 no. 12 no. 16 no. 20 no. 30 no. 40 no. 50 no. 70 no. 100 no. 140 no. 200 no. 270 no. 400
Percent finer by weight
Percent coarser by weight
90 80 70 60 50 40 30 20 10
10 20 30 40 50 60 70 80 90
Wet
Dry
mm 100 50 10 5 1 0.5 0.1 0.05 mm
Cobbles
Gravel
Coarse
Fine
Sand
Coarse
Medium
Fine
Fines

DEPOSIT 8

Location: Valley bottom of the Meikle River.

No. of associated pits/sites: 1

No. of samples analysed: 1

DEPOSIT DESCRIPTION:

See description below. A helicopter survey of the river indicated the presence of scattered outcrops of material. The number of outcrops is minor compared to the number along the Hotchkiss River and they are likely to consist of much dirtier material.

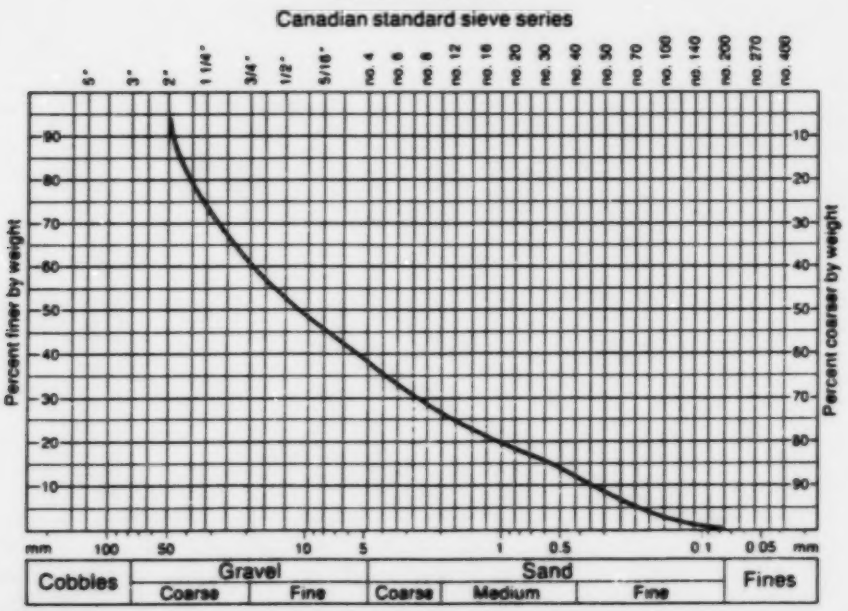
Site Location: Sec SE3 Tp96 R3 W6M

Site Description:

Very dirty bouldery, gravelly sand to 1.5m rests on shale bedrock below 1m of fine, cross-bedded sand overburden. The lens of material exposed is 75m long and is present for an unknown distance behind the face of the river bank. The material fines upward in the thickest section of the lens to clasts of 3cm. At the west end of the lens the most common clast size is 25-35cm. The material is dirtiest near the contact with the shale and shale clasts are very abundant for the first 75cm upward. This material should be crushed for best use. The shale content likely will limit its use to road base.

Gradation:		
	0% cobbles	61.2% gravel
	38.1% sand	0.7% fines

Gradation curve



DEPOSIT 9

LOCATION: Sec NE12 Tp95 R1 W6M

No. of associated pits/sites: 1

No. of samples analysed: 1

DEPOSIT DESCRIPTION:

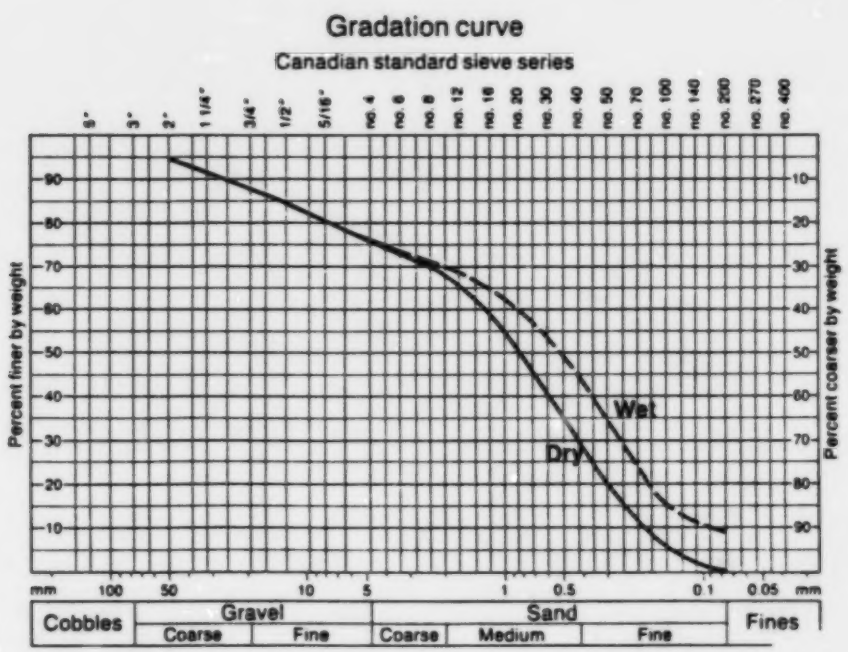
Isolated occurrence of dirty gravelly sand that is almost depleted.

Pit Location: Sec NE12 Tp95 R1 W6M

Pit Description:

Approximately 1m of dirty gravelly sand below 75cm of till overburden on both sides of the road. This material appears to be an isolated occurrance that does not extend beyond the currently exposed boundaries. No similar material is present in any of the borrow pits to the south or north of this location.

Gradation:	0% cobbles	23.9% gravel	dry sieve
	74.2% sand	1.9% fines	
	0% cobbles	23.9% gravel	wet sieve
	66.9% sand	9.2% fines	



PITS/SITES OUTSIDE DEPOSITS

Site Location: Sec SE25 Tp95 R4 W6M

Site Description:

Helicopter landing. Elevation 2870'. Recently logged area. Till with granite and quartzite clasts less than 0.3%. Results of a 100m traverse eastward with the EM31 indicate the material is till.

Site Location: Sec SW34 Tp95 R4 W6M

Site Description:

Helicopter landing. Elevation 2920'. No outcrop. Results from a 150m traverse with the EM31 indicate the material is till.

Site Location: Sec NE22 Tp95 R5 W6M

Site Description:

Helicopter landing. Elevation 2910'. Results from a 200m traverse with the EM31 indicate the material is till.

Site Location: Sec NE2 Tp96 R5 W6M

Site Description:

Helicopter landing. Elevation 2800'. Till with quartzite clasts approximately 1%. Results from a 350m traverse starting from Chinchaga Road along a NE cut line with the EM31 indicate the material is till.

Site Location: Sec SE2 Tp96 R6 W6M

Site Description:

Helicopter landing. Till. Elevation 2930'. Results from a 100m traverse south along a cut line with the EM31 indicate the material is till.

Site Location: Sec SE5 Tp96 R6 W6M

Site Description:

Helicopter landing. Till with quartzite clasts less than 0.5%. Elevation 3100'. Results from a 300m traverse west along a cut line with the EM31 indicate the material is till.

Site Location: Sec SW12 Tp96 R6 W6M

Site Description:

Helicopter landing. Elevation 2920'. Till with granite clasts less than 0.5%. Results from a 100m traverse along a cut line with the EM31 indicate the material is till.

Site Location: Sec SW18 Tp96 R6 W6M

Site Description:

Helicopter landing. Till. Elevation 3060'. Results from a 140m traverse southwest along a winter road with the EM31 indicate the material is till.

Site Location: Sec SE3 Tp96 R7 W6M

Site Description:

Helicopter landing. Till with quartzite clasts less than 5%. Elevation 2920'. Results from a 450m traverse west along a cut line with the EM31 indicate the material is till.

Pit Location: Sec SW29 Tp96 R10 W6M

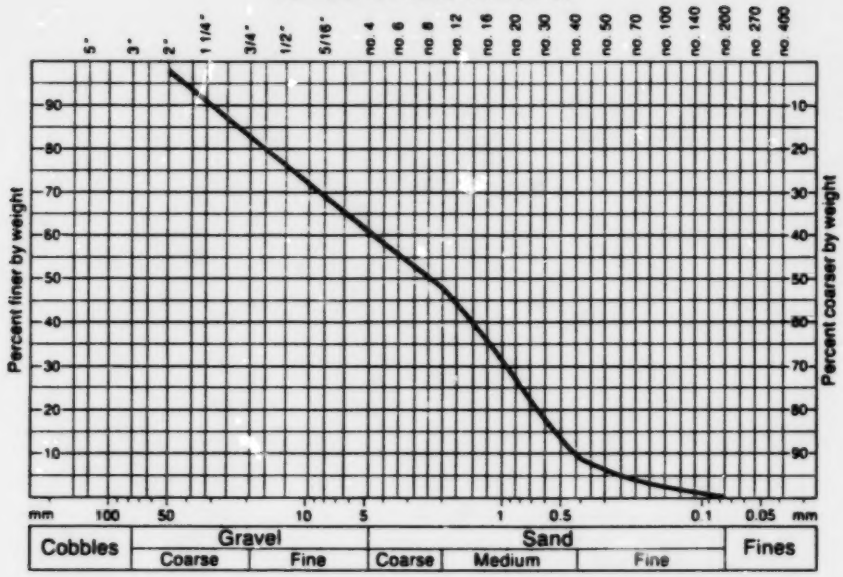
Pit Description:

This roadside pit of very dirty gravelly sand is 2m deep and the top 0.5m is gravelly till. The lower 1.5m consist of sand and gravelly clay bands. Maximum clast size is 40cm but most material is smaller than 4mm. Clasts consist of granite, hard sandstone, clay, gneiss, ironstone and lignite.

Gradation:	0% cobbles	38.1% gravel
	60.7% sand	1.2% fines

Gradation curve

Canadian standard sieve series



MAPS
NOT
FILMED

CARTES
OMISES